REMARKS

The foregoing amendment amends claims 1, 8 and 9. Now pending in the application are claims 1-15, of which claim 1 is independent. The following comments address all stated grounds for rejections and place the presently pending claims, as identified above, in condition for allowance.

Objection to the Specification

The Abstract is objected to because the Abstract includes more than 150 words. In response, Applicants amend the specification to reduce the number of words in the Abstract. In light of the foregoing amendments to the specification, Applicants request the Examiner to reconsider and withdraw the objection to the specification.

Objection to Claims 8 and 9

Claims 8 and 9 are objected to because the term "active regions" lack proper antecedent basis. In response, Applicants amend claims 8 and 9 to address the issues raised by the Examiner in the Office Action. Support for the claim amendment can be found at page 20, lines 1-11 of the specification. No new matter is added. In light of the foregoing claim amendments, Applicants request the Examiner to reconsider and withdraw the objection to claims 8 and 9.

Rejection of Claims 1-12 and 14 under 35 U.S.C. §102

Claims 1-12 and 14 are rejected under 35 U.S.C. §102(a) as being anticipated by UK Patent Application Publication No. GB 2 361 071 ("Walker"). Applicants respectfully traverse the rejection for the following reasons.

Independent claim 1 is directed to a Mach-Zehnder interferometer modulator for modulating a beam of laser light. The modulator includes a pair of separate waveguides through which the laser light is passed. There are provided opposed pairs of electrodes electrically located so as to be able to effect optical changes within the material of the waveguides. One of the electrodes of each pair is formed in a doped layer, and the other electrode, a top electrode, is a surface metalisation. The doped layer is trenched so that adjacent electrodes in the doped layer

are electrically isolated from one another so that one of the electrodes in the doped layer can be connected with a different electrical polarity to the other electrode in the doped layer thereby permitting the connection of the pairs of electrodes in parallel anti-phase mode. Claims 2-12 and 14 depend from claim 1.

Applicants respectfully submit that Walker does not disclose that *the doped layer is trenched so that adjacent electrodes in the doped layer are electrically isolated from one another so that one of the electrodes in the doped layer can be connected with a different electrical polarity to the other electrode in the doped layer thereby permitting the connection of the pairs of electrodes in parallel anti-phase mode*, as recited in claim 1.

Walker discloses an embodiment of the prior art that is equivalent to the prior art described with reference to Figures 2a-3 of the pending application. Each waveguide (40, 41) has a top electrode (45, 46) above the optical mode and a backplane electrode provided by the conductive region (43). The conductive region (43) provides a backplane electrode, which stretches beneath both waveguides and has a high conductivity, so the portions of backplane electrode beneath each waveguide are electrically connected. Consequently, a single two-terminal driver can only provide a signal to the two top electrodes in the configuration shown in Fig 2a, i.e. such that the waveguides have electric fields in opposing directions that are electrically connected in series.

In both Walker and the present invention, the ridge waveguides are optically defined by a shallow etch such that the optical mode is weakly guided substantially below the defined ridge. However, the claimed invention includes a deep trench (117 in Figs. 6 and 7) between the two waveguides. This provides a degree of electrical isolation between the two waveguides, enabling them to be connected in different configurations.

The first embodiment of the present invention described with reference to Figs. 6 and 7 shows a configuration in which the two waveguides are connected in parallel, using two electrodes, one to drive (107), and the other to ground (108). The second embodiment of the present invention described with reference to Figs 8 and 9 shows a different electrical connection scheme in which three bulk electrodes are used; a central electrode (81) that is driven

and two grounded electrodes (80, 82). The second embodiment uses a central deep trench (89) and connects the waveguides in parallel. It also includes a second deep trench (88).

The third embodiment of the present invention described with reference to Fig 10 is similar to the second embodiment, but without the direct contact (86) between the top of one waveguide and the bottom of the other. Similarly, the embodiment described with reference to Fig 10b is similar to the embodiment in Fig 7, but without a direct electrode contact to each backplane electrode (114a, 114b).

The examiner asserts in the Office Action that the claimed invention is anticipated by Walker because Walker discloses the trenches (46, 48) at page 15, line 16. Applicants respectfully disagree. Walker does not disclose the trenches (46, 48) through the conductive layer (44). Consequently, since the conductive layer is not partitioned by a deep trench in Walker, one of the electrodes in the conductive layer cannot be isolated and connected with a different electrical polarity to the other, as recited in the claimed invention.

In the Mach-Zehnder modulator of the claimed invention, each of the two waveguides is provided with a pair of electrodes to effect optical changes within the material of the waveguide. The pairs of electrodes are electrodes (120, 114a) and electrodes (121, 114b), respectively. In Walker, the pairs of electrodes would be electrodes (40, 44) and electrodes (42, 44) respectively, rather than electrode (40, 42) as stated by the examiner in the Office Action. One of the electrodes of each pair (114a, 114b) is formed in a doped layer buried within or below the waveguide material. The doped layer is trenched (117) so that adjacent electrodes in the doped layer are electrically isolated from one another so that one of the electrodes in the doped layer can be connected with a different electrical polarity to the other electrode in the doped layer thereby permitting the connection of the pairs of electrodes in parallel anti-phase mode.

The Examiner asserts that the trenches (46, 48) of Walker correspond to the trench (117) of the present invention, which is defined as electrically isolating the adjacent electrodes in the doped layer from one another. The trenches (46, 48) of Walker, however, do not electrically isolate adjacent electrodes which are able to effect optical changes within the material of the waveguides. Instead, the electrode (44) of Walker is a single, common, electrode for *both* waveguides (there is no isolating trench between them). The trenches (46, 48) of Walker isolate

the single common electrode from the remainder of the doped layer (24), so that the electrode (44) is not "pinned to ground potential." See Walker, page 15, lines 13-19.

Additionally, with regard to the ability of the claimed invention to connect one of the electrodes in the doped layer with a different electrical polarity to the other electrode in the doped layer, as recited in claim 1, the examiner asserts that Walker disclose this feature at page 10, lines 3 and 4. Applicants respectfully disagree.

Walker discloses that by virtue of the capacitive element used by Walker the *magnitude* of the electrical signal across the electrode pair of one arm is different to that across the electrode pair of the other arm (thereby imparting a pre-determined frequency chirp in the optical output). Walker, however, does not disclose connecting one of the electrodes in the doped layer with a different *electrical polarity* to the other electrode in the doped layer.

Furthermore, the Examiner asserts that Walker discloses at page 6, lines 13 and 14 the feature of connecting the pairs of electrodes in parallel anti-phase mode. Walker simply discusses *prior art* and summarizes possible drive configurations in general, one of which is parallel anti-phase. Walker's devices are driven *in series* rather than in parallel. Indeed, driving the devices in parallel in Walker is not possible since the devices of Walker do not include the trench that is used in the present invention.

In light of the foregoing arguments, Applicants submit that Walker does not disclose each and every element of claim 1. Applicants therefore request the Examiner reconsider and withdraw the rejection of claims 1-12 and 14 under 35 U.S.C. §102(a) and pass the claim to allowance.

Rejection of Claim 13 under 35 U.S.C. §103

Claim 13 is rejected under 35 U.S.C. §103(a) as being unpatentable over Walker in view of U.S. Patent No. 5,757,985 ("Ishizaka"). Applicants respectfully traverse the rejection for the following reasons.

Claim 13 depends from claim 1 and adds separate and patentable limitations to claim 1. Ishizaka is cited by the Examiner to provide teachings for the limitations recited in claim 13.

Ishizaka, however, does not teach that *the doped layer is trenched so that adjacent electrodes in the doped layer are electrically isolated from one another so that one of the electrodes in the doped layer can be connected with a different electrical polarity to the other electrode in the doped layer thereby permitting the connection of the pairs of electrodes in parallel anti-phase mode*, as recited in claim 1. In light of the foregoing arguments, Applicants submit that the combination of Walker and Ishizaka does not teach or suggest all of the limitations of claim 1. Claim 13, which depends from claim 1, is not rendered obvious over the cited prior art references. Applicants therefore request the Examiner reconsider and withdraw the rejection of claim 13 under 35 U.S.C. §103(a) and pass the claim to allowance.

Rejection of Claim 15 under 35 U.S.C. §103

Claim 15 is rejected under 35 U.S.C. §103(a) as being unpatentable over Walker in view of U.S. Patent No. 6,122,414 ("Shimizu"). Applicants respectfully traverse the rejection for the following reasons.

Claim 15 depends from claim 1 and adds separate and patentable limitations to claim 1. Shimizu is cited by the Examiner to provide teachings for the limitations recited in claim 15. Shimizu, however, does not teach that *the doped layer is trenched so that adjacent electrodes in the doped layer are electrically isolated from one another so that one of the electrodes in the doped layer can be connected with a different electrical polarity to the other electrode in the doped layer thereby permitting the connection of the pairs of electrodes in parallel anti-phase mode*, as recited in claim 1. In light of the foregoing arguments, Applicants submit that the combination of Walker and Shimizu does not teach or suggest all of the limitations of claim 1. Claim 15, which depends from claim 1, is not rendered obvious over the cited prior art references. Applicants therefore request the Examiner reconsider and withdraw the rejection of claim 15 under 35 U.S.C. §103(a) and pass the claim to allowance.

Conclusion

In view of the above amendment, applicant believes the pending application is in condition for allowance.

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Respectfully submitted,

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